Connecting Patterns Through Environmental Education

Photo: Miriam S. Wetzel

Neal Maine is the biology teacher I've always wished I'd had. "Education" means at its root "to lead forth," and Maine's classes at Seaside High School have been led forth year after year into the environment of Oregon's north coast. The students learn to ask their own questions about the ecosystems that have surrounded them all their lives—the streams, the estuary, the shore, the fir and spruce forests—or about problems facing the community. Their training in science comes as they learn how to pursue the answers, and to communicate their knowledge even as they learn.

For two years, Maine's classes, entirely on their own initiative, wrote, edited, and distributed the "Student Oceanography Newsletter," which went out to schools in 35 states. Seaside High students have produced slide shows on such subjects as forest fire management and the value of "snags" (standing dead trees) as wildlife habitat—shows that were subsequently presented at public meetings.

Maine's students often begin by studying salmon, one of the area's most valuable resources, whose decline is a cause of widespread concern. Often stu-

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Through environmental education educators can integrate all subject matter into the story of our struggle to adapt to a world we are forever transforming.

dents become so fascinated by the streams or estuaries through which the salmon pass that, by following their own questions, they change their focus from the individual creature to the entire ecosystem. To these students, "biology" has little to do with facts memorized, tests taken, and experiments performed; it isn't merely a requirement to be checked off along a predetermined pathway to degree and career; it is a means of learning how the world works.

Yet Neal Maine is troubled about the effects of this form of education. His students emerge with a vision of a world composed of intricately related systems and cycles. They have an inkling that "biology," "chemistry," and so forth are simply different avenues to understanding a world that doesn't divide itself into neat categories. They have been led forth, and they are excited by what they have found. Then they return to those circumscribed human environments, the home, the school, the job, and find that this vision isn't considered appropriate. All too often they find that patient observation of systems and cycles and the knowledge that all things interrelate are incompatible with conventional academic subjects and economic goals and community attitudes. Providing an integrated education that will "unify the cubbyholes we all tend to stay in can create internal conflict and even family conflict," worries Maine.

The Task of Modern Education

The world is beset by a wide range of threats to long-term ecological stability, and since stability and biological survival are closely linked, there is a case to be made that an essential task, perhaps the paramount task, of modern education is to prepare students to cope with these "environmental problems." The magnitude of the threats to the biosphere is great enough that there is urgency in the need for better education about the immediate dangers. And yet this education will have failed in its most important role if it treats the environment as an alien place where problems occur due to "human impact," and which may or may not encumber humankind with inconvenient "limits." The paradox is that to get to the root of our environmental problems, we must learn to see that the environment is not a separate subject at all.

We must begin with the world as we find it, though, and in that world the words "the environment" conjure up a parade of horribles. No reader of this magazine needs to be told that we are plagued by pollution, erosion, species endangerment, and the dwindling of the resources on which industrial society depends. But it is entirely possible for any intelligent person to feel inundated by the details—a PCB spill here, radioactive leakage there, the clubbing of baby seals somewhere else. It is entirely possible to gather, from the isolated incidents reported in the press, that "environmentalism" consists of sentimental concern over individual species and beauty spots, and to wonder sincerely whether the snail darter, the Furbish lousewort, the white-water stretches of the Stanislaus River, or the sagebrush plains of Wyoming are really vital to human well-being.

It is even possible, for those who aren't paying enough attention, to take comfort in the protestations of purblind

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technocrats that things are actually getting better: that urban airsheds are less polluted, that pesticides are adequately regulated, that fusion or fission or orbiting photovoltaic arrays will solve our energy dilemma.

What is missing here is a sense of the depth and pervasiveness of the threats to ecological stability. It must be understood that the cumulative effects of the behavior of one species—homo sapiens—are very close to reducing the capacity of the global environment to sustain that same species, and millions of other species as well. Just to make sure that we are all talking about the same thing when we discuss "the environment" as an issue worthy of the schools' attention, consider:

- There are, roughly, some 10 million species of organisms on the planet at this moment, about 1.5 million of which have been scientifically identified. But this biological diversity is being rapidly reduced. Extinction of as many as one-fifth of all the earth's species is possible by the turn of the century, projecting current rates of deforestation, conversion of wild land to urban and agricultural uses, and other development. Mass extinction at this rate will almost certainly result in unpredictable alterations of global nutrient cycles (nitrogen, sulphur, carbon, and so on), the composition of the atmosphere, and soil productivity.
- Tropical forests are the planet's greatest reservoir of biological diversity, embracing from two-fifths to one-half of all species. A 1976 study indicated that tropical forests are being cut down at the rate of 42,000 acres per year around the globe. At this rate, half of all these forests will be gone in something over 50 years, but exponential population growth in tropical countries makes it likely that the rate of deforestation will correspondingly increase. The loss of these breathing, moisture-bearing, heat-retaining forests will alter the world's weather patterns, among other things.
- From one-fifth to one-third of the earth's tillable cropland is losing topsoil at a rate that is undermining its long-term productivity.
- No exact figures are available, but it is known that millions of acres have been transformed into desert through the impact of agriculture and forestry practices. Roughly six percent of the earth's surface is now considered desert, but another 28 percent is at risk of becoming so, according to one estimate. From an anthropocentric point of view, this would represent an overwhelming reduction of the global environment's food, fiber, and fuel needed to sustain our species.
- Hopeful eyes are often turned toward the oceans as a future source of food, but in reality most of the 30 or so common food species of fish are currently being harvested at levels beyond the yield their numbers can sustain.

Global Problems

This parade of grim realities could be a long one; we could go on to speak of acid rain and loss of estuaries and wetlands and the increase of carbon dioxide in the atmosphere and many more. What all these "environmental problems" have in common is that they involve the relationship of the globally dominant species—homo sapiens—to the global environment. They cannot be addressed merely through laws or political considerations or "marketplace" factors in any one country. They pose a distinct threat that within decades or a very few generations the earth may become a biologically more limited place, which would have obvious and dire implications for the species now perched precariously at the top of the food chain.

If these threats are acknowledged as real, no educational system hoping to prepare its students for citzenship in the world could fail to treat "the environment" as an important subject. Even if a more skeptical attitude is taken, future citizens must be given the tools to weigh environmental arguments.

But parading the horribles, as I have done, is part of the problem. It reinforces the concept of "the environment" as something apart from ourselves upon which we have "impacts" if we are not careful. It leads to the assumption that the "natural" and the "human" are separate worlds in collision, and that the task of environmental education is to assist us in keeping the former safe from the latter.

The immediate threats are real, I am well and truly convinced, but they all stem from the same root, that sense of separateness. What is needed in education is not a new item in the curriculum devoted to "the environment," but a new approach to the structure of knowledge. Rather than terrifying students about ecological disaster, the educational system should produce students who understand that the global environment is simply the way the world works, with humankind, as a globally dominant species, a very important part of that environment. That is a more hopeful, less paralyzing view of the world, and a profounder and more fascinating challenge to education.

Studying Patterns

If Neal Maine's students are unusual, it is primarily because their education has been integrated in a way that transcends separate categories of subject matter and instead takes its pattern from the environment. Instead of abstractions, they have learned ecosystems and cycles, and, just as important, they have begun to understand the ways in which they are active participants in those systems and cycles. They have begun to follow what cyberneticist Gregory Bateson calls "the pattern which connects."

Studying the pattern which connects should be the mandate of education for two reasons. First, because humankind, by means of its brain the most successful competitor among the planet's current burden of species, has penetrated every niche and habitat on the globe; this perfectly natural event has presented our species with the tremendous evolutionary challenge of consciously learning to adapt to a global environment. Current environmental problems are the symptoms of our failure to adapt thus far. Failure to learn in the relatively near future may well result in our extinction, or at least the drastic modification of our environment, another perfectly natural event that educators and other humans will nevertheless wish to forestall. Knowledge of the patterns which connect us to the rest of the global environment would thus be a precursor to our learning to adapt and central to any sane educational program.

Second, as we struggle to make this adaptation, the structure of our knowledge evolves as well. As the study of the pattern which connects, environmental education is actually the most appropriate model for assimilating new information in the sciences.

The Cartesian World View

The organization of the sciences, and in many ways of Western thought generally, lies in the Cartesian world view. The legacy of Rene Descartes was a mechanistic conception of the world, in which all matter was broken down into small, discrete building blocks and cause-and-effect was simply the direct impact of one unit of matter upon another. Only one thing stood apart from this mechanically operating material universe—reason, found exclusively in the human brain. And the ultimate use of this reason was to express the mechanical operation of the universe in mathematical terms; geometry was all.

The Cartesian world view came most obviously to dominate physics, but in reality it became the core of all scientific thinking. Just as physics was a search for the smallest units of matter, and the direct, cause-and-effect forces (such as gravity) between these units, biology became an effort to understand how the machine of life worked. The human body itself was conceived of as a machine whose function was to carry around the reasoning faculty. The fundamental principle of all the sciences became reductionism, the idea that the goal of science is to disassemble the machine into its constituent parts to see how they work individually.

It took a long time for the implications to sink in, but virtually all of 20th century physics has transcended the Cartesian model, beginning with Einstein's formulations making it clear that mass and energy are different expressions of the same thing. Physics pursued Cartesiansim to the reductionist end, and emerged on the other side with the revelation that there are no ultimate building blocks. The universe, from a physicist's point of view, can no longer be understood by breaking matter down to individual pieces and then building up laws of causation. Instead, quantum theory and statistical mechanics have introduced us to a universe that is basically a series of interrelationships rather than things. Nothing can be studied by itself; rather, nature is a web of interconnections, making possible non-local forms of causation unexplainable by means of universe-as-clockwork reductionism.

The "life sciences" have been very, very slow in moving away from the reductionist model. Our study of life on earth is still abstractly subdivided into "biology," "chemistry," "molecular biology," "biochemistry," "genetics," and even, as a separate discipline, "ecology." Our research funding and our most brilliant work still tend to go toward ever more reductive efforts to find the "building blocks of life," even while the ecosystems upon which life on earth depends wither unheeded outside the window. Except in certain classrooms in Louisiana, evolution is now understood to be a fundamental principle of biology, but evolution is all too often studied in terms of the reassembly of these building blocks into new organic machines, which will then begin to respond to an external "environment."

Still, as we have traveled far enough from ourselves to look back and photograph the earth as a whole, heartbreakingly alive and vibrant against the blackness of the interstellar deeps, the life sciences too have begun to see their subject as an entity, made up of interconnections rather than an accumulation of discrete parts.

Evolution is coming to be seen as something more than the competition of species against species, let alone of individuals within a species. Rather, evolution is a matter of constant feedback within and among species. As we come to understand that long-term ecological stability is a key to survival, the focus begins to shift away from "Nature, red in tooth and claw" toward such concepts as "group selection" and even "ecosystem selection"; it begins to appear that those groupings of species that optimize the chances for each other's survival last longest. (Recent work in paleoanthropology, which tends to support the idea that the key to protohumankind's success was its superior ability to cooperate, contributes toward this shift in thinking.) It is the totality of

these interrelationships that makes up the environment.

The Gaia Hypothesis

The evolving shape of the life sciences can perhaps be seen in the "Gaia hypothesis" put forward by J. E. Lovelock, a British interdisciplinary scientist who holds degrees in chemistry, medicine, and biophysics. Lovelock and other scientists after him are thinking seriously about the primitive, pre-Cartesian concept of Mother Earth (the Greek goddess Gaia). Lovelock's idea, still clearly labeled a hypothesis, is that the interconnections of life are in truth those of a single organism or living system. Until very recently, it had not been explicitly recognized by many scientists—even though it is inherent in things that had long been known—that biological processes play a major role in such phenomena as the continually breathable gaseous composition of the atmosphere and the constant level of salinity in the ocean. The Gaia hypothesis takes this new understanding one step further, proposing that this constant creation by life on earth of its own environment is in some sense purposive, a meaningful process of monitoring and responding to such challenges as the cyclic changes in the sun's energy output.

This concept is far removed from the despairing notion of a problem-fraught "environment" placing limits on humanity. It emphasizes instead humankind's interconnections with the environment as a whole, restoring even war and industrial pollution—not to mention scientific research!—to their place as products of the "natural" environment. It hardly gives us a license for ecological abuse, since the extinction of an unstable species might well be the response of a self-regulating environment; but it does place the current parade of horribles in a calmer perspective and allow for humanity's creative if non-imperial function in modifying our environment. Playfully accepting Lovelock's hypothesis for a moment, we might even wonder if the development of an environmentally oriented curriculum in the schools might not be Gaia's strategy for correcting the excesses of her most rambunctious children.

True environmental education, then, should be about the pattern which connects. It can serve as a paradigm for teaching even at the earliest levels—perhaps especially there—and can lead to an integration of knowledge in which students understand that "biology," "chemistry," "ecology" and all the rest are subsets of the same study, and understand how these subject matters may apply to the environment and to their role in its continuing evolution. And environmental education is not merely a means of integrating subject matter in the sciences. Political science, history, sociology, and the arts can be thought of as different versions of the story of humankind's struggle to adapt to an environment it is forever transforming.

We urgently need better education about the state of our environment if we are to adapt and survive. But in order to adapt, we need not only to transform the world but to be transformed. The most important goal of environmental education should be to guide us from separateness to relatedness.□

References

Bates, Marston. *The Forest and the Sea*. New York: Random House, 1960.

Bateson, Gregory. *Mind and Nature*. New York: E. P. Dutton, 1979.

Brown, Lester R. *Building a Sustainable Society*. New York: W. W. Norton, 1981.

Capra, Fritjof. *The Turning Point*. New York: Simon and Schuster, 1982.

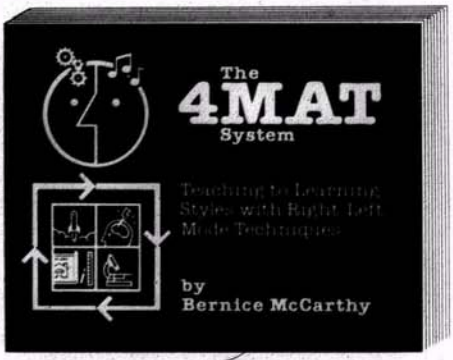
Ehrlich, Paul; Ehrlich, Anne; and Holdren, John. *Ecoscience: Population, Resources, Environment*. San Francisco: W. H. Freeman & Co., 1970.

Ehrlich, Paul, and Ehrlich, Anne. *Extinction: The Cause and Consequences of the Disappearance of Species*. New York: Random House, 1981.

Lovelock, J. E. *Gaia: A New Look at Life on Earth*. Oxford: Oxford University Press, 1979.

Myers, Norman. *The Sinking Ark*. Elmsford, New York: Pergamon Press, 1979.

U.S. Department of State and Council on Environmental Quality. *The Global 2000 Report to the President*. Washington, D.C.: Government Printing Office, 1980.



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